Water cycle reservoirs are like people in swimming pools, a college, a movie theater, a bus, etc.

**1**. The water cycle contains several reservoirs. Let’s choose one; surface water which refers to the water in lakes and streams. We can compare that with a reservoir of people such as a college.

A. List three ways surface water and a college are similar.

*1. They both have matter (water molecules and people) that moves in and out of the reservoir.*

*2. They are both found in specific areas of the world. Lakes and rivers tend to be most common in high precipitation regions and colleges tend to be in more urban areas.*

*3. The inflow and outflow from both tends to be seasonal.*

B. List three ways they are different

*1. Water molecules in lakes and rivers are the same as the rest of the water molecules in the world but people in colleges tend to be from a specific age group.*

*2. A few lakes and rivers contain the majority of surface water whereas a few colleges and universities do not serve the majority of students*

*3. Many people in the world depend on surface water to live. They do not need a college education to survive.*

Note: This exercise could be repeated with different reservoirs such as oceans vs. buses, or glaciers vs. movie theaters. After doing one or two of these, we could give students a water cycle reservoir such as groundwater and ask them to think of a reservoir from some other domain.

**2.** The residence time of water in a glaciers (a water cycle reservoir) is like the residence time of people in swimming pools.

A. List three ways the residence time of water in glaciers is similar to the residence time of people in swimming pools.

*1. The residence time of water in glaciers and people in swimming pools depend in part on temperature.*

*2. The residence time of both tends to be seasonal.*

*3. The residence time of both would decrease if there were an increase outflow such as global warming and melting of glaciers or a widespread fear of water-born disease in swimming pools.*

B. List three ways they are different.

*1. High temperatures would decrease the residence time of water in glaciers but increase the residence time of people in swimming pools.*

*2. The residence time of water in glaciers is in thousands of years but the residence time of people in swimming pools is only minutes or 10’s of minutes.*

*3. The residence time of water in glaciers would is affected by the rate of sublimation but sublimation doesn’t effect people leaving a pool.*

3. Now let’s look at a similarity where some of the actual process may be similar. For example, the residence time of water in a swimming pool is similar to the residence time of water in the oceans.

A. List three ways the residence time of water in a swimming pool is similar to residence time of water in the oceans.

*1. In both cases, evaporation is the major outflow from the reservoir.*

*2. The residence time of water in the oceans and a pool are both decreased if the temperature increases.*

*3. The residence time of water in the oceans could increase by increasing the volume of the oceans (e.g. raising sea level) while the residence time of water in a swimming pool could increase by making it larger.*

B. List three ways in which residence time of water in a swimming pool is similar to residence time of water in the oceans.

*1. Water may drain (outflow) from the bottom of a pool but not from the bottom of the ocean*

*2. The residence time of water in the oceans is much longer than the residence time of water in a swimming pool because pools are drained at least once a year.*

*3. One can easily increase the residence time in a swimming pool by covering it and reducing evaporation. The oceans are only partially covered by ice in the Arctic.*

C. Given some of the similarities between oceans and swimming pools, describe an experiment that you could do with swimming pools that might tell you something about the residence time of water in the oceans.

*I would look at the ratio of area of the surface of the pool compared to its depth to determine how fast the water evaporates and use that to predict how fast oceans with different lengths, widths and depths may evaporate. Where the evaporation rate is higher, the residence time should decrease*

*I would put some big fans next to some pools and determine how much wind velocity might change the evaporation rate. Where the evaporation rate is higher, the residence time should decrease*

D. Assessment- this would be given to both classes as a test question.

Would the residence time of water increase, decrease, or remain the same if all the glaciers on earth were to melt? Explain your reasoning.

*The residence time would increase because the water from the glaciers would be distributed among the other water system reservoirs. Therefore, the size of the other reservoirs, including the atmosphere would increase. This assumes that the flux of water into and out of the atmosphere would not change. It is possible that with no glaciers, the world would be even warmer because of the decrease in albedo. A warmer atmosphere can hold more water so this would further increase the size of the atmosphere reservoir, making the residence time even longer.*